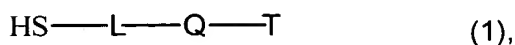


CLAIMS

1. An alkanethiol of formula (1) and the enantiomers of the alkanethiol of formula (1):



wherein -L- is $-(\text{A}_x-\text{B}_y-\text{E}_z-\text{D})_w$;

each A, B, E and D are individually $\text{C}(\text{R}_\text{A}\text{R}_\text{A}')$ -, $-\text{C}(\text{R}_\text{B}\text{R}_\text{B}')$ -, $-\text{C}(\text{R}_\text{E}\text{R}_\text{E}')$ -, and $-\text{C}(\text{R}_\text{D}\text{R}_\text{D}')$ -, respectively;

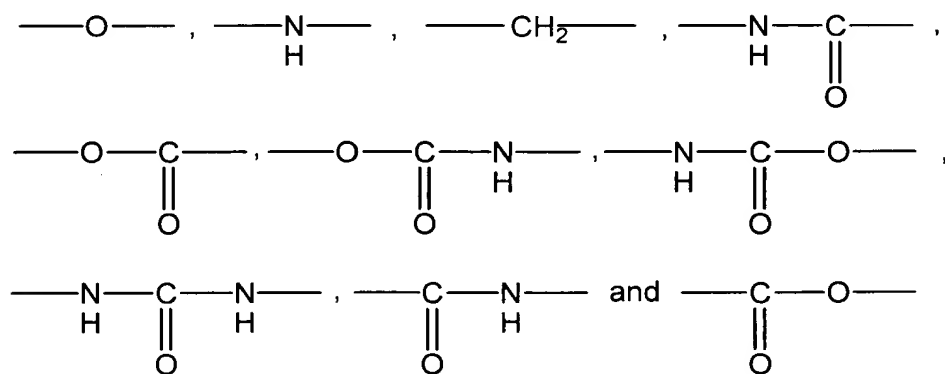
each R_A , R_B , R_E and R_D are individually H, or any two of R_A , R_B , R_E and R_D together form a bond, or R_A , R_B , R_E and R_D together with the atoms to which they are bonded form a six-membered aromatic ring;

each R_A' , R_B' , R_E' and R_D' are individually H, or any two of R_A' , R_B' , R_E' and R_D' together form a bond, or R_A' , R_B' , R_E' and R_D' together with the atoms to which they are bonded form a six-membered aromatic ring;

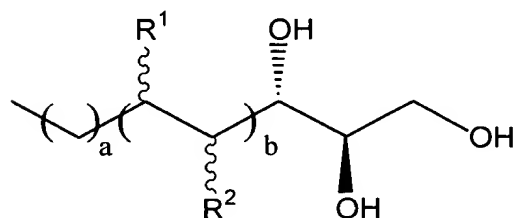
each x, y and z are individually either 0 or 1;

w is 1 to 5;

-Q- is selected from the group consisting of



-T is a moiety of formula (2)



(2);

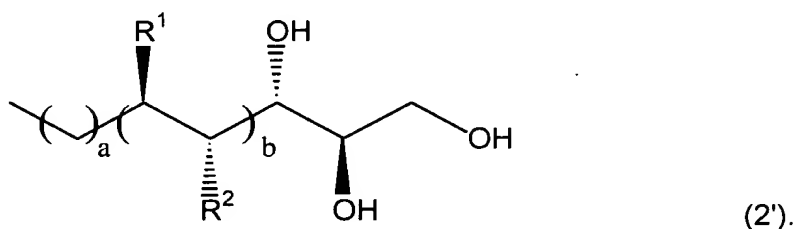
R^1 and R^2 are each individually selected from the group consisting of H and OH;

a is 0 to 3;

b is 0 to 3; and

~~~~~ indicates that the chirality of the carbon atom to which it is attached is either R or S.

2. The alkanethiol of claim 1, wherein -T is a moiety of formula (2')



3. The alkanethiol of claim 2, wherein a is 1, b is 1 and at least one of  $R^1$  and  $R^2$  is OH.

4. The alkanethiol of claim 2, wherein -L- contains 8 to 18 carbon atoms.

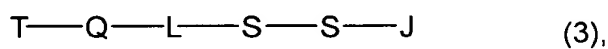
5. The alkanethiol of claim 4, wherein -L- contains 1 or 0 double bonds, or 1 triple bond.

6. The alkanethiol of claim 2, wherein -L- is an alkylene containing 6 to 18 carbon atoms.

7. The alkanethiol of claim 2, wherein -Q- is -O- or -CH<sub>2</sub>-.

8. The alkanethiol of claim 3, wherein -L- is an alkylene containing 6 to 18 carbon atoms, and -Q- is -O-.

9. A disulfide of formula (3) and the enantiomers of the disulfide of formula (3):



wherein -L- is  $-(A_x-B_y-E_z-D)_w$ ;

5

10

w is 1 to 5:

$$\begin{array}{c} \text{---O---}, \text{---}\underset{\text{H}}{\text{N}}\text{---}, \text{---CH}_2\text{---}, \text{---}\underset{\text{H}}{\text{N}}\text{---}\overset{\text{O}}{\underset{\text{O}}{\parallel}}\text{C---}, \\ \text{---O---}\overset{\text{O}}{\underset{\text{O}}{\parallel}}\text{C---}, \text{---O---}\overset{\text{O}}{\underset{\text{O}}{\parallel}}\text{C---}\underset{\text{H}}{\text{N}}\text{---}, \text{---}\underset{\text{H}}{\text{N}}\text{---}\overset{\text{O}}{\underset{\text{O}}{\parallel}}\text{C---O---} \\ \text{---}\underset{\text{H}}{\text{N}}\text{---}\overset{\text{O}}{\underset{\text{O}}{\parallel}}\text{C---}\underset{\text{H}}{\text{N}}\text{---}, \text{---}\overset{\text{O}}{\underset{\text{O}}{\parallel}}\text{C---}\underset{\text{H}}{\text{N}}\text{---} \text{ and } \text{---}\overset{\text{O}}{\underset{\text{O}}{\parallel}}\text{C---O---} \end{array}$$

(2);

15

**b** is 0 to 3;

20

-J is selected from the group consisting of H, halogen, R, -OR, -NRR', -C(O)R, and -C(O)OR;

R is selected from the group consisting of alkyl, alkenyl, alkynyl, aryl and heterocyclic radical; and

5 R' is selected from the group consisting of H, alkyl, alkenyl, alkynyl, aryl and heterocyclic radical.

10. The disulfide of claim 9, wherein -J is a moiety of formula (4):

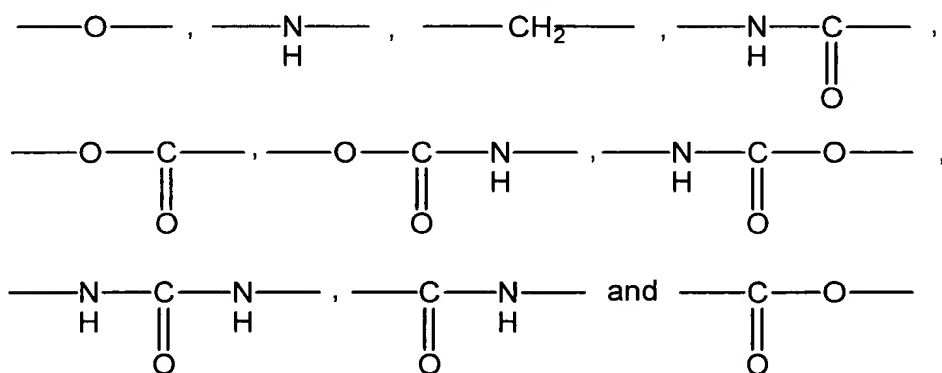


an alkyl having 1 to 4 carbon atoms, or  $-(\text{CH}_2)_c(\text{OCH}_2\text{CH}_2)_n\text{OH}$ ;

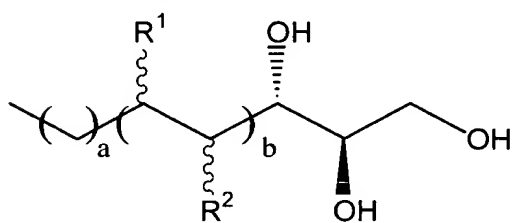
10 and

wherein -L' is  $-(\text{A}_x\text{-B}_y\text{-E}_z\text{-D})_w$ ;

-Q' is selected from the group consisting of



-T' is a moiety of formula (2)



(2);

15

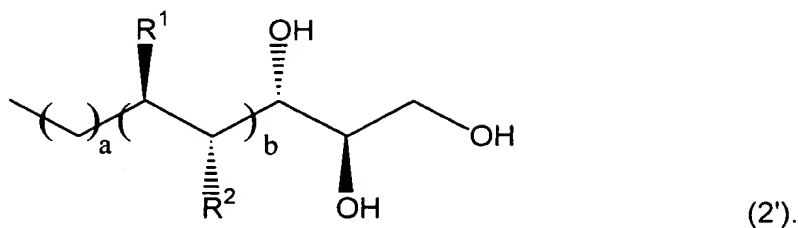
c is 2 to 20, and

n is 1 to 3.

11. The disulfide of claim 9, wherein -J is a moiety of formula (4'):



12. The disulfide of claim 11, wherein -T is a moiety of formula (2')



13. The disulfide of claim 12, wherein a is 1, b is 1 and at least one of R<sup>1</sup> and R<sup>2</sup> is OH.

14. The disulfide of claim 12, wherein -L- contains 8 to 18 carbon atoms.

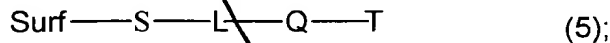
15. The disulfide of claim 14, wherein -L- contains 1 or 0 double bonds, or 1 triple bond.

16. The disulfide of claim 12, wherein -L- is an alkylene containing 6 to 18 carbon atoms.

17. The disulfide of claim 12, wherein -Q- is -O- or -CH<sub>2</sub>-.

18. The disulfide of claim 13, wherein -L- is an alkylene containing 6 to 18 carbon atoms, and -Q- is -O-.

19. A substrate, comprising:  
 (i) a surface layer comprising gold, and  
 (ii) a plurality of moieties, on at least a portion of said surface layer,  
 wherein said moieties are alkanethiolate moieties of formula (5)  
 and enantiomers of the alkanethiolate moieties of formula (5):



-L- is -(A<sub>x</sub>-B<sub>y</sub>-E<sub>z</sub>-D)<sub>w</sub>;

each A, B, E and D are individually C(R<sub>A</sub>R<sub>A'</sub>)-, -C(R<sub>B</sub>R<sub>B'</sub>)-, -C(R<sub>E</sub>R<sub>E'</sub>)-, and -C(R<sub>D</sub>R<sub>D'</sub>)-, respectively;

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In a<sup>9</sup>

a<sup>9</sup>

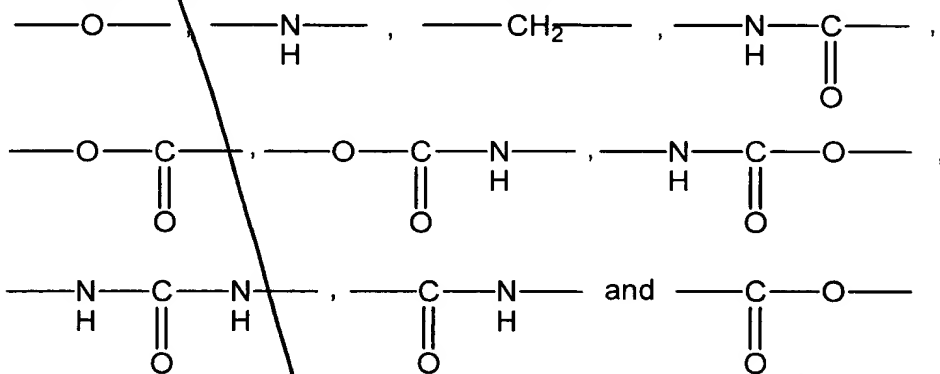
each  $R_A$ ,  $R_B$ ,  $R_E$  and  $R_D$  are individually H, or any two of  $R_A$ ,  $R_B$ ,  $R_E$  and  $R_D$  together form a bond, or  $R_A$ ,  $R_B$ ,  $R_E$  and  $R_D$  together with the atoms to which they are bonded form a six-membered aromatic ring;

each  $R_A'$ ,  $R_B'$ ,  $R_E'$  and  $R_D'$  are individually H, or any two of  $R_A'$ ,  $R_B'$ ,  $R_E'$  and  $R_D'$  together form a bond, or  $R_A'$ ,  $R_B'$ ,  $R_E'$  and  $R_D'$  together with the atoms to which they are bonded form a six-membered aromatic ring;

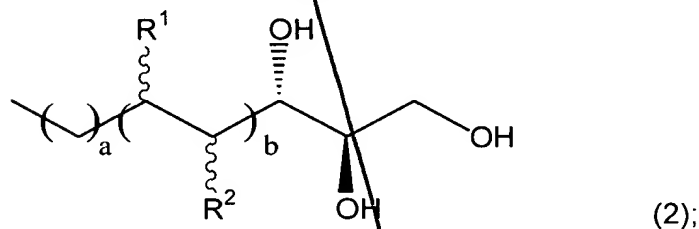
each  $x$ ,  $y$  and  $z$  are individually either 0 or 1;

$w$  is 1 to 5;

-Q- is selected from the group consisting of



-T is a moiety of formula (2)



$R^1$  and  $R^2$  are each individually selected from the group consisting of H and OH;

$a$  is 0 to 3;

$b$  is 0 to 3;

~~~~~ indicates that the chirality of the carbon atom to which it is attached is either R or S; and

Surf designates where the moiety attaches to said surface.

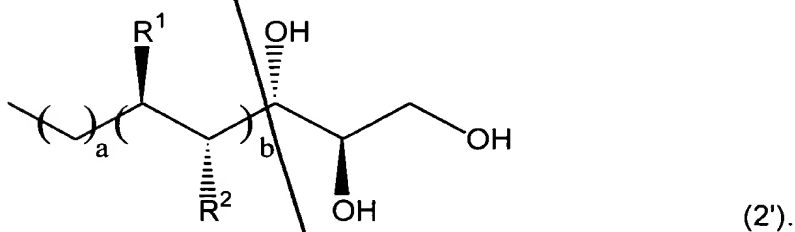
20. The substrate of claim 19, further comprising:

(iii) a monolayer comprising said moieties,
wherein said monolayer does not fail a cell patterning test at 12
days.

21. The substrate of claim 19, further comprising:

(iv) a base,
wherein said surface layer is on said base.

22. The substrate of claim 21, wherein -T is a moiety of formula (2')



23. The substrate of claim 22, wherein a is 1, b is 1 and at least one of R¹ and R² is OH.

24. The substrate of claim 22, wherein -L- contains 8 to 18 carbon atoms.

25. The substrate of claim 24, wherein -L- contains 1 or 0 double bonds, or 1 triple bond.

26. The substrate of claim 22, wherein -L- is an alkylene containing 6 to 18 carbon atoms.

27. The substrate of claim 22, wherein -Q- is -O- or -CH₂-.

28. The substrate of claim 23, wherein -L- is an alkylene containing 6 to 18 carbon atoms, and -Q- is -O-.

29. A substrate, comprising:

(i) a surface layer comprising gold, and

(ii) a monolayer comprising moieties, on at least a portion of said surface layer,

wherein said moieties are alkanethiolate moieties; and
said monolayer does not fail a cell patterning test at 12 days.

5

30. A cell chip, comprising:
(A) the substrate of claim 19, and
(B) cells, on said substrate.

10

31. A cell chip, comprising:
(A) the substrate of claim 20, and
(B) cells, on said substrate.

15

32. A cell chip, comprising:
(A) the substrate of claim 22, and
(B) cells, on said substrate.

33. A cell chip, comprising:
(A) the substrate of claim 24, and
(B) cells, on said substrate.

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34. A cell chip, comprising:
(A) the substrate of claim 26, and
(B) cells, on said substrate.

25

35. A cell chip, comprising:
(A) the substrate of claim 28, and
(B) cells, on said substrate.

36. A cell chip, comprising:
(A) the substrate of claim 29, and
(B) cells, on said substrate.

37. A method of making the alkanethiol of claim 1, comprising:
hydrolyzing a thioester, to form the alkanethiol of formula (1).

38. The method of claim 37, wherein said thioester contains OH groups protect with acetone.

39. A method of making the disulfide of claim 9, comprising:
oxidizing a first alkanethiol, to form the disulfide of formula (3).

5 40. The method of claim 39, further comprising oxidizing a second alkanethiol simultaneously with said first disulfide.

Sub A10
41. A method of making a substrate, comprising contacting a surface with the alkanethiol of claim 1;
wherein said surface comprises gold.

10 *Sub B1*
42. A method of making a substrate, comprising contacting a surface with the alkanethiol of claim 1;
wherein said surface comprises gold.

Sub B1
15 43. A method of making a substrate, comprising contacting a surface with the alkanethiol of claim 2;
wherein said surface comprises gold.

44. A method of making a substrate, comprising contacting a surface with the alkanethiol of claim 8;
wherein said surface comprises gold.

20 45. A method of making a substrate, comprising contacting a surface with the disulfide of claim 9;
wherein said surface comprises gold.

46. A method of making a substrate, comprising contacting a surface with the disulfide of claim 11;
wherein said surface comprises gold.

25 47. A method of making a substrate, comprising contacting a surface with the disulfide of claim 12;
wherein said surface comprises gold.

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48. A method of making a substrate, comprising contacting a surface with the disulfide of claim 18;

wherein said surface comprises gold.

5 *Sub B1*

49. A method of making a cell chip, comprising:
contacting cells with the substrate of claim 19.

50. The method of claim 49, further comprising allowing said cells to proliferate.

51. A method of making a cell chip, comprising:
contacting cells with the substrate of claim 20.

52. The method of claim 51, further comprising allowing said cells to proliferate.

53. A method of making a cell chip, comprising:
contacting cells with the substrate of claim 22.

54. The method of claim 53, further comprising allowing said cells to proliferate.

55. A method of making a cell chip, comprising:
contacting cells with the substrate of claim 28.

56. The method of claim 55, further comprising allowing said cells to proliferate.

57. A method of making a cell chip, comprising:
contacting cells with the substrate of claim 29.

58. The method of claim 57, further comprising allowing said cells to proliferate.

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